

Diabetes Care in North Carolina

Are We on Track for *Healthy People 2010*?

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DIABETES, THE FIFTH LEADING CAUSE of death in North Carolina¹ and the sixth leading cause nationally,² was responsible for 13% of all hospitalizations and over 1900 deaths in this state in 1998.² Using data from the Behavioral Risk Factor Surveillance System (BRFSS) developed by the Centers for Disease Control and Prevention (CDC), we examined North Carolina's diabetes care indicators from 1994-2000, projected levels for the year 2010, and compared these projections to the national diabetes-related goals established by *Healthy People 2010*.³

The BRFSS is a state-based, random-digit-dialed telephone survey of adults, used to collect standardized information at the state and national levels on a variety of health behaviors and preventive health practices related to the leading causes of death and disability. During 1994-2000, it was used to interview 19,677 North Carolina adults, including 1,223 adults with diabetes. *Healthy People 2010* is a set of declared national health goals from the US Department of Health and Human Services, used to track progress at both the state and national levels. It lists four diabetes-specific goals, stated in terms of percentage of compliance among all persons diagnosed with diabetes: annual glycosylated hemoglobin (or hemoglobin A1c), daily blood glucose monitoring, annual eye exam, and annual foot exam. In addition, there are two goals for high-risk groups including diabetic: annual flu vaccine and one-time pneumonia vaccine.

The main independent variable in our analysis was the calendar year. For the dependent variables, we dichotomized the frequency of blood glucose monitoring, receiving the key diabetes care procedures in the past year (glycosylated hemoglobin, foot exam, dilated eye exam, influenza vaccine) and ever receiving pneumonia vaccine. It should be noted that the wording of the question regarding glycosylated hemoglobin was revised in the year 2000, which hindered analysis for this question. Because of the complex sampling design, SUDAAN was used to analyze the data and test for

trends over the study years. A simple linear regression approach was used to evaluate the *Healthy People 2010* objectives.

Among the participants reporting a diagnosis of diabetes, the mean age was 60.4 years, 46% were female, 27% were black, 71% were white, and 2% were other racial or ethnic groups. The Table shows the yearly percentages for all diabetes indicators. The prevalence of diabetes increased from 4.1% in 1994 to 6.5% in 2000. Daily blood glucose monitoring, yearly influenza vaccines, and pneumonia vaccines had significant upward trends from 1994 to 2000. Yearly glycosylated hemoglobin slowly increased from 20% to 26.6% between 1994 and 1999; in 2000, however, it increased markedly to 99.5%.

The most concerning of the indicators is the foot exam, which shows a decreasing trend in the past 6 years. Foot exams have been shown to play an important role in reducing foot ulcers and lower extremity amputations.^{4,5} Given this evidence, the decline in foot exams may lead to increased morbidities for patients with diabetes.

For those indicators with significant trends, we projected rates and compared them to *Healthy People 2010* goals. If current trends continue in North Carolina, 10.8% of the adult population will have diabetes at the decade's end. Projected diabetes indicator levels include 70% for daily blood sugar monitoring, 74% for yearly influenza vaccine and 85% for pneumonia vaccination.

One diabetes indicator, glycosylated hemoglobin, is currently at the target level of the *Healthy People 2010* goals. The indicators of blood glucose monitoring, influenza and pneumonia vaccines showed significant trends toward improvement between 1994-2000. Of these, the only indicator projected to reach *Healthy People 2010* goals is daily blood glucose monitoring.

The interesting increase in obtaining glycosylated hemoglobin should be challenged. From 1994-1999 people

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Table. Yearly percentages for all diabetes indicators from the North Carolina BRFSS

Indicator	Healthy People 2010 Goal	94	95	96	Year 97	98	99	00	P value
Yearly glycosylated hemoglobin	50%	20.0	20.2	13.2	15.6	11.8	26.6	99.5*	N/A
Daily glucose monitoring	60%	33.1	30.5	40.7	36.4	41.5	46.4	44.5	0.004
Yearly eye exam	75%	72.0	59.7	53.5	72.8	66.9	71.3	69.6	0.237
Yearly foot exam	75%	86.2	85.7	55.4	51.8	46.4	65.8	68.4	<0.001
Yearly flu vaccine	90%	—	35.1	—	56.7	—	43.3	52.7	0.01
Pneumococcal vaccine	90%	—	17.7	—	39.1	—	37.6	41.6	0.001
Number of BRFSS respondents:		106	172	151	210	179	175	230	

*question format changed for 2000

with diabetes were asked if they had “Heard of a glycosylated hemoglobin or hemoglobin A1c.” If they responded yes, then they were asked, “About how many times in the last 12 months has a doctor, nurse, or other health professional checked you for a glycosylated hemoglobin or hemoglobin A1c?”. In 2000, the two-part question was combined to “A test for hemoglobin A1c measures the average level of blood sugar over the past three months. About how many times has a doctor, nurse or other health professional checked you for hemoglobin A1c?”. It is possible that the new question may be oversensitive and further validation should be done.

There are many limitations to these data. First, the BRFSS is self-reported data. However, since *Healthy People 2010* goals are based upon the BRFSS data, we can compare our state data with national goals. The yearly numbers of persons with diabetes are small and subject to variation, thus subgroups by race and ethnicity could not be analyzed. Also, because of the manner in which the BRFSS data are collected, it is not representative of people who are non-

English-speaking or do not have telephones. The North Carolina Center for Health Statistics and the North Carolina Diabetes Prevention and Control Unit are currently translating the BRFSS questions into Spanish in order to conduct over-sampling of North Carolina’s rapidly increasing Spanish-speaking population.

In conclusion, although North Carolina has shown improvement in three of the diabetes care indicators, most diabetes indicators fall short of *Healthy People 2010* goals. Intervention is needed to reverse the decline in foot exams and to increase the rate of other indicators, such as flu vaccinations, that fall furthest from the goals.

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REFERENCES

- Valeriano E, Reaves J, Porterfield D, Munoz-Plaza C. Diabetes in North Carolina: a summary report. Raleigh, NC: Diabetes Prevention and Control Unit, Division of Public Health, NC DHHS, 2001.
- Minino AM, Smith B. Deaths: preliminary data for 2000. National Vital Statistics Reports;49(12). Hyattsville, MD: National Center for Health Statistics.
- US Department of Health and Human Services. *Healthy People 2010*, 2nd ed. With Understanding and Improving Health and Objectives for Improving Health. 2 vols. Washington, DC: US Government Printing Office, November 2000.
- McCabe CJ, Stevenson RC, Dolan AM. Evaluation of a diabetic foot screening and protection program. *Diabetic Med* 1998; 1998:80-84.
- Litzelman DK, Slemenda CW, Langefeld CD, et al. Reduction of lower extremity clinical abnormalities in patients with non-insulin dependent diabetes mellitus. A randomized, controlled trial. *Ann Intern Med* 1993; 119:36-41.